Water Hammer Simulations of MMH Propellant – New Capability Demonstration of the

Generalized Fluid Flow Simulation Program

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Abstract

Fluid Transient analysis is important for the design of spacecraft propulsion system to ensure structural stability of the system in the event of sudden closing or opening of the valve. Generalized Fluid System Simulation Program (GFSSP), a general purpose flow network code developed at NASA/MSFC is capable of simulating pressure surge due to sudden opening or closing of valve when thermodynamic properties of real fluid are available for the entire range of simulation. Specifically GFSSP needs an accurate representation of pressure-density relationship in order to predict pressure surge during a fluid transient. Unfortunately, the available thermodynamic property programs such as REFPROP, GASP or GASPAK does not provide the thermodynamic properties of Monomethylhydrazine (MMH). This paper will illustrate the process used for building a customized table of properties of state variables from available properties and speed of sound that is required by GFSSP for simulation. Good agreement was found between the simulations and measured data. This method can be adopted for modeling flow networks and systems with other fluids whose properties are not known in detail in order to obtain general technical insight. Rigorous code validation of this approach will be done and reported at a future date.